CLAIMS

I claim:

1. A method for multi photon excitation of a sample, comprising the steps of
   - splitting a laser beam into at least two coherent partial beams each having a beam axis and a same intensity distribution about its beam axis;
   - directing the partial beams from different directions towards a common measuring plane running transversely to the beam axes at an inclination angle <1 between the beam axes of the partial beams;
   - and projecting the partial beams onto the measuring plane by means of a common lens system,

an interference pattern formed by the coherent partial beams within the measuring plane providing areas of maximum light intensity adjacent to areas of minimum light intensity.

2. The method of claim 1, wherein a lateral offset of the partial beams in the measurement plane caused by the inclination angle is smaller than 50 % of a full width at half-maximum (FWHM) of an intensity distribution of each partial beam in the measuring plane.

3. The method of claim 2, wherein the lateral offset of the partial beams in the measurement plane caused by the inclination angle is at maximum 25 % of the full width at half-maximum (FWHM) of the intensity distribution of each partial beam in the measuring plane.

4. The method of claim 1, wherein the partial beams are focused in at least one common measuring point within the measuring plane.

5. The method of claim 1, wherein a phase of at least one of the partial beams is modulated by varying a path length of the respective partial beam so that the areas of maximum intensity of the interference pattern are moved forth and back in the measuring plane.

6. The method of claim 4, wherein the partial beams are focused in a plurality of measuring points which are arranged side by side in the measuring plane at the same time, the partial beams interfering with each other in all of these measuring points.

7. The method of claim 6, a distance of the areas of maximum light intensity in the interference pattern is at least half as wide as a distance of the measuring points.

8. A device for multi photon excitation comprising:

- a laser providing a laser beam,
- a beam splitter splitting a laser beam into at least two coherent partial beams each having a beam axis and a same intensity distribution about its beam axis,
- beam directing means directing the partial beams from different directions towards a common measuring plane running transversely to the beam axes at an inclination angle <1 between the beam axes of the partial beams, and
- a common lens system projecting the partial beams onto the measuring plane,

an interference pattern formed by the coherent partial beams within the measuring plane providing areas of maximum light intensity adjacent to areas of minimum light intensity.

9. The device of claim 8, wherein the beam directing means include a roof mirror joining the partial beams which are directed towards the roof mirror from opposite directions at its roof ridge.

10. The device of claim 8, wherein the beam directing means include a deviation element modulating a phase of at least one of the partial beams by varying a path length of the respective partial beam.

11. The device of claim 8, wherein the lens system includes a micro lens array made of a plurality of micro lenses arranged side by side in one plane for focusing the partial beams in a plurality of measuring points which are arranged side by side in the measuring plane at the same time, the partial beams interfering with each other in all of these measuring points.

12. The device of claim 11, wherein the inclination angle is smaller than Lambda (M*NA*f), Lambda being the wavelength of the laser beam and the partial beams, M being the magnification upon focusing the partial beams into each measuring point, NA being the numeric aperture of the lens systems, and f being the focal length of each micro lens of the micro lens array.

LIST OF REFERENCE NUMERALS

1	Device
2	partial arrangement
3	partial arrangement
4	laser
5	beam splitter
6	deviation mirror
7	deviation mirror
8	deviation mirror
9	roof mirror
10	laser beam
11	partial beam
12	partial beam
13	roof ridge
14	inclination angle
15	optical axis
16	piezo element
17	telescope
18	micro lens array
19	axis
20	micro lens wheel
21	lens system
22	Lens
23	Objective
24	Sample
25	Ocular
26	Camera
27	Mirror
28	Mirror
29	Curve
30	Curve
31	area
32	curve
33	area
34	curve